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ABSTRACT

This booklet provides guidelines for administrators, curricula directors, mathematics coordinators and supervisors, mathematics department chairmen, and classroom teachers for the orderly evaluation of improved mathematics programs. The purpose of the booklet was (1) to identify the kind of organization that enables the implementation, coordination, and administration of good mathematics programs, (2) to outline general principles of curriculum planning and revision, and (3) to define the responsibilities of various school personnel in the revision process. The guidelines for stimulating a sound mathematics program are featured in sections on (1) planning for change, (2) organizing the mathematics curriculum, (3) implementing an improved mathematics curriculum, and (4) evaluating the mathematics curriculum. (RP)

Administrative Responsibility for Improving Mathematics Programs

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American Association of School Administrators
Association for Supervision and Curriculum Development
National Association of Secondary-School Principals
National Council of Teachers of Mathematics

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FOREWORD

MANY and varied proposals for changing the mathematics curricula of the schools are being made by responsible organizations, study groups, curriculum committees, educational councils, government agencies, and individual citizens. Evaluating and implementing these suggested changes has placed a heavy burden on administrators, curricula directors, mathematics coordinators and supervisors, mathematics department chairmen, and classroom teachers.

To provide guidelines for the orderly evolution of improved mathematics programs, four national education organizations formed the Joint Project on the Administration of Mathematics Programs. Representatives were appointed by the American Association of School Administrators, the National Council of Teachers of Mathematics, the Association for Supervision and Curriculum Development, and the National Association of Secondary-School Principals.

The purposes of the group were to identify the kind of organization that enables the implementation, coordination, and administration of good mathematics programs; to outline general principles of curriculum planning and revision; and to define the responsibilities of various school personnel in the revision process.

This publication is the result of a series of joint discussions concerning these purposes. Major writing responsibility was accepted by M. Vere DeVault, Department of Curriculum and Instruction, University of Wisconsin, Madison, Wisconsin. Other participants were Robert J. Alfonso, associate secretary, Association for Supervision and Curriculum Development, Washington, D.C.; Frank B. Allen, chairman, Mathematics Department, Lyons Township High School and Junior College, La Grange, Illinois; William J. Ellena, associate secretary, American Association of School Administrators, Washington, D.C.; Charles R. Hucka, assistant executive secretary, National Council of Teachers of Mathematics, Washington, D.C.; Margaret Jones, principal, Bannockburn Elementary School, Bethesda, Maryland; Mildred Keiffer, supervisor of mathematics, Public Schools, Cincinnati, Ohio; Archibald B. Shaw, chairman, Department of Administration and Higher Education, College of Education, Michigan State University, East Lansing, Michigan; Robert J. Shockley, assistant superintendent, Allegany County Schools, Cumberland, Maryland; Warren C. Seyfert, associate director, Curriculum Service Center, National Association of Secondary-School Principals, Washington, D.C.

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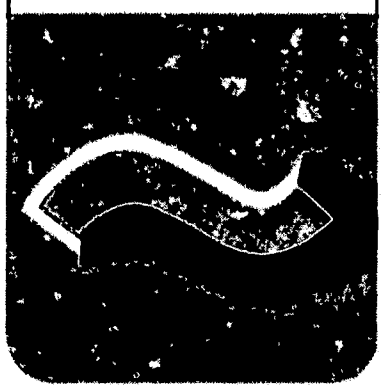
Your Leadership Position

This bulletin has been prepared for administrators who are concerned about the effective participation of their faculties in the constantly changing area of mathematics instruction. Lay people as well as teachers are asking many questions, posing many problems, and defending a variety of points of view about the instructional program in mathematics.

These interests and questions are a natural by-product of the nation's growing need for mathematical knowledge and skills. The resurgence of mathematics in modern science and a vital and increasing need for new forms of mathematics in business, finance, and industry are responsible for this growing need. It is not realistic to attempt to educate children properly without paying attention to these dominating forces in our environment. The world of today with its scientific culture forms the most logical basis for anticipating the needs of the world of tomorrow. Assuredly the future cultural environment of the individual will be heavily dependent upon mathematics. [25.]*

Introduction



The student who may be capable of unusual scientific or mathematical achievement can be completely discouraged from any mathematical interest by poor or uninspired teaching in the early grades. Unfortunately, this interest may be difficult or impossible to arouse during later years. The challenge also is to teach basic mathematical principles to students who will not be specialists in science or who will not follow careers directly dependent upon mathematics. [25, 26.]

Chemists and physicists have found new uses and interpretations for mathematics; biologists are applying mathematics to the study of genetics; businessmen are using mathematics in scheduling production and distribution; sociologists are using complicated statistical ideas; game theory has been found to have important applications to human behavior; mathematical models give promise as a basis for the interpretation of phenomena in many disciplines. Mathematics is thus woven into the basic fabric of our society. The strength of this fabric—in fact, the very survival of our nation—may well depend on the

*** Numerals in brackets refer to the numbered items of the Bibliography.**

amount and kind of mathematics taught in our schools. This is a great and sobering responsibility for those who design and administer the mathematics program. [17.]

Mathematics is one of several rapidly changing subject areas calling for immediate and sustained attention. This change will continue to require the persistent efforts of all to remain well informed and confident regarding the quality of our school programs.

Characteristics of Modern Programs

The emphasis in mathematics programs today is upon mathematical structures learned in an atmosphere of active inquiry. The student is encouraged to think for himself and to realize that there are often many ways to reach a solution. He meets many basic mathematical ideas very early, and he broadens and deepens these concepts as long as he continues in the mathematics sequence.

One of the important new ideas in the teaching of mathematics is that learning is not made more difficult when instruction includes complete, mathematically correct, and more sophisticated explanations. Master teachers have always known this and have acted upon it in their classes. The stress upon more adequate understanding enables the schools to teach more mathematics in the same time, and it makes the experience of learning mathematics more rewarding for the student. Mathematics is presented as a way of thinking. In the very process of learning the concepts, skills, and uses of mathematics, the student has a valuable experience. Even when some facts are forgotten, the student will retain ideas and skills concerning proof, correct language, and inferential thinking. [1, 6, 12, 17, 24, 26, 29.]

Teachers report that pupils at all levels of achievement can learn mathematics when appropriate explanations are given. The structure approach is effective with slow-moving classes as well as with honors classes.

It is recognized that school systems vary tremendously in every dimension. Therefore, to provide a blueprint for improving a mathematics program is an impossible task. Not so impossible, however, is the task of providing a set of guiding principles to help an administrator effectively guide the improvement of the mathematics curriculum for which he is responsible. These guiding principles fall into four main areas: (1) planning for change in the mathematics curriculum, (2) organizing the mathematics curriculum, (3) implementing an improved mathematics curriculum, and (4) evaluating the mathematics curriculum. [26.]

1 Planning for Change

- *Planning for a changing mathematics curriculum should follow the identification of objectives.* Each school system must select objectives that are valid in its own environment. The following objectives, which have been agreed upon by many people in the field of mathematics, may serve as guidelines for the individual school district. [1, 6, 12, 17.]

- The content of an improved mathematics program should—

  Lead the student to understand the language, concepts, structures, and techniques of mathematics.

  Have mathematical integrity which involves internal consistency, accuracy, and precise vocabulary.

  Develop in the student a sensitivity to patterns in mathematics.

  Develop an appreciation of the broad cultural aspects of mathematics and its contribution to the development of the modern world.

- The methods of teaching in an improved mathematics program should—

  Reflect the findings of nationally recognized authorities and writing groups in mathematics and learning theory [1, 8, 24, 26].

  Provide for applications of the subject matter and for sufficient practice to fix concepts and maintain skills.

Guidelines for Stimulating a Sound Mathematics Program

Employ, where possible, an inductive approach providing for student discovery.

Provide opportunities and encouragement for student imagination and creativity.

Employ a deductive process for the testing of hypotheses and the analysis of structure.

Employ a level of rigor appropriate for the mathematical maturity of the student.

Provide for individual differences so that students of all levels of ability can achieve maximum growth in a continuous program appropriate for each student.

Provide opportunities for students to experiment, observe, and generalize.

Provide for presenting the content sequentially.

Develop in the students a sense of general problem solving through mathematics.

- A mathematics curriculum should also—

  Plan for meeting the educational and vocational objectives of the individual student [24, 26].

  Help each student reach at least minimal competencies [8].

  Be designed to meet the needs of a constantly changing technological society [17].

- *Planning for a changing mathematics curriculum should take into account the competencies and needs of the faculty which will implement the changes* [8].

  - The Mathematical Association of America has endorsed certain minimum standards for the training of teachers on various levels, as shown in the table below, which is reproduced from *Recommendations for the Training of Teachers of Mathematics* [9].

Teaching Assignment	Degree	High School Prerequisites	Number of College Mathematics Courses
Elementary School	B.A.	Two Years of College Preparatory Mathematics	4
Elements of Algebra and Geometry	B.A., Math Minor	Preparation for Analytic Geometry and Calculus	7
High School	B.A., Math Major	Preparation for Analytic Geometry and Calculus	11
Elements of Calculus, Linear Algebra, Probability, Etc.	M.A. in Math	Preparation for Analytic Geometry and Calculus	Approx. 18

The college mathematics courses required to meet the above recommendations are described in the same source [9].

- An interest in mathematics and a desire to learn more about teaching are indicated by teachers' participation in professional mathematics organizations and associated activities. Such participation should be encouraged. [23.]

- All assignments should leave a definite time in the teacher's schedule for individual and/or group study. Administrators should also provide a well-planned in-service education program. [4, 19, 23, 34, 36.]

- *Planning for a changing mathematics curriculum should be the responsibility of designated persons who are qualified both in mathematics and in curriculum design and implementation.* Specific individuals in the school system, whether that system be large or small, should be designated to develop the curriculum in mathematics. They should have more education and experience in mathematics, mathematics education, and curriculum design than is

expected of a classroom teacher. Those who could be expected to serve effectively in the responsibility are—

- Teachers with advanced education in mathematics who are knowledgeable and concerned about emerging mathematics programs.
- Chairmen of mathematics departments.
- Mathematics supervisors [18].

- *Planning for a changing mathematics curriculum should involve all personnel who participate in the mathematics program.* One of the most difficult but important tasks faced by program builders is that of effectively involving those persons who will implement the program. Effective ways must be found to involve teachers and curriculum directors as well as administrators in the planning of the mathematics curriculum. [6, 17, 24, 26.]

- *Planning for a changing mathematics curriculum should provide for continuous in-service education of teachers both in mathematics content and in methods of mathematics instruction.* The mathematics program not only has changed but will continue to change. The changing nature of the program results in a need for continuous in-service education. Teachers are increasingly recognizing that change is in the nature of current curriculum development, and that their tasks as teachers will constantly change in the years ahead. Ample time and help should be provided so that classroom teachers can remain alert to these changes. Many teachers, particularly at the elementary school level, have fears about their ability to understand and teach mathematics. An adequate in-service program helps overcome this fear. [4, 6, 19, 23, 34, 36.]

- *Planning for a changing mathematics curriculum should provide a way for informing the community about the mathematics program.* Parent and lay help and support are invaluable in carrying out the plans successfully. This support can be achieved by keeping the public informed about new ideas in mathematics education. A number of approaches

might be considered. [6, 10, 17, 20, 21, 22, 26, 27, 35.]

- One or more parent-teacher association meetings can be devoted to presenting some new ideas [27, 35].
- Extension courses from a nearby college or university can be offered.
- Vocational and adult night schools can offer evening classes focused on some new ideas in mathematics [22].
- Appropriate materials can be secured from professional organizations and distributed in the community [20].
- Local newspapers can publish feature articles on mathematics in the schools.

Organizing the Mathematics Curriculum

- *A mathematics curriculum should be coordinated with the content of other disciplines.* There are various ways to coordinate the mathematics program with other disciplines. This coordination should be carefully planned, and some consideration should be given to various thought processes as they relate both to mathematics and to the other content areas in the curriculum. The relationship of mathematics and science is particularly important here and should be planned in order that the concepts and skills necessary for science applications may be taught in time to be useful. [8, 33.]
- *Balance should be maintained among the various subject areas.* During a time of changing curriculum patterns, the need for continuous efforts to maintain balance is particularly important. While the importance of mathematics is recognized, achievement in this area should not be stressed at the expense of other vital subject areas. [8, 26, 33.]
- *Planning for a changing mathematics curriculum should provide for continued experimentation with a variety of promising materials and methods.* Much impetus for growth can result from the trial classroom use of new materials, provided the materials

are carefully selected and the teachers properly prepared. After trying them out, all involved in the mathematics curriculum should engage in a systematic discussion and evaluation of the materials to determine their strengths and weaknesses. [1, 6, 10, 12, 17, 26, 32, 33.]

- *A mathematics curriculum should provide continuous opportunity for the student to study in an appropriate mathematics program in which he is challenged and in which he can succeed.* The excellence of a program is perhaps best represented by the manner in which a suitable balance is achieved between challenge to the student on the one hand and opportunity for success on the other. At all levels the program should be designed to provide each student with both a challenge and an opportunity to succeed. An effective curriculum is one that expands in such a variety of ways that individual differences become greater as students progress through the grades. Differences in intelligence, learning style, and specific kinds of mathematical understanding; differences in learning rate; and differences in vocational goals should be provided for. Five mathematics courses, for example, might be necessary to meet the range of needs at the tenth-grade level. The greater the variety in the program, the more opportunities arise for meeting individual differences. [1, 8, 13, 14, 17, 33.]

- *A mathematics curriculum should include all grade levels in a variety of continuous programs of instruction.* Continuity of program development as a child progresses from kindergarten through high school is of the utmost importance. The task is to design a program in such a manner that, although there is a variety of possible programs through which the many students might progress, each child will be assured of a continuous, sequential program adapted to his ability and vocational goals. [8, 16, 17, 33.]

Implementing an Improved Mathematics Curriculum

- For effective implementation of an improved mathe-

matics curriculum, the administrator must involve individual faculty members of his school [17].

- Each elementary and secondary school teacher of mathematics should be encouraged to deepen his understanding of both the mathematics content and the instructional method of the changing curriculum.
- Each elementary and secondary school teacher of mathematics should be encouraged to apply for special grants and institute fellowships to extend his understanding of the new curriculum. These are available in increasing numbers from the U.S. Office of Education, the National Science Foundation, and other sources. [23.]
- Funds should be made available for teaching aids, resource books, and other material to implement the curriculum. In addition, the teachers should be provided with instructional materials: reports, newsletters, and bulletins from other curriculum projects around the country; materials from commercial publishers; and professional books containing both mathematics content and methods of instruction. [2, 3, 5, 30, 31, 32.]
- Teachers should be encouraged to attend professional meetings where issues and trends in mathematics instruction are discussed.
- Arrangements should be made for orientation of new teachers to the mathematics program and to the plans for future development.
- The teaching preparation, special capacities, and interests of each staff member should be studied so that his teaching assignment makes effective use of his training and skill.

- An administrator has the responsibility to assist the entire faculty in—
  - Selecting appropriate published materials—both experimental and commercial—to implement the curriculum [1, 11, 12, 19].
  - Working in curriculum planning, organization, and implementation. Only as people are actively

involved in all stages of program development will they feel a responsibility to make the program succeed. [10.]

- Planning in-service education programs the teachers want and need to maintain the improved mathematics curriculum. Channels of communication between staff members trained in mathematics and those who make administrative decisions should be kept open. Action should follow only after all concerned have studied the problem and recommended the action. [4, 23.]
- Forming study groups and workshops with the full financial support of the school [4, 23].

- An administrator has the responsibility to provide adequate and continuing consultant and supervisory service to ensure the success of the improved mathematics curriculum [18].
- An administrator has the responsibility to identify and use available resources in a creative way. Here are some suggestions:
  - An outstanding teacher whose work with children is creative and imaginative might be observed by other teachers. This outstanding teacher could be working within the local system or in other communities.
  - A teacher who has recently participated in college or university courses might serve as a resource person to faculty study groups.
  - A group of high school teachers might provide assistance to a group of elementary or junior high school teachers [28].
  - A period of released time from classroom duties for teachers to use in personal research, curriculum study projects, or classroom observation could be provided.
  - A period during the regular school day when department chairmen can function as resource persons for other faculty members could be arranged.

- Various resources at the state and national levels could be utilized. They might include college courses and well-planned degree programs, summer institutes, or resource persons from state college and university faculties or the state department of education.

Evaluating the Mathematics Curriculum

- *Curriculum evaluation must be in terms of the objectives identified by each school.* Each objective should be defined in terms of pupil performance so that it is possible to determine the extent to which the objectives have been reached. [15.]

- *Curriculum evaluation should be continuous.* Classroom teachers should cooperate in an effort to evaluate the results of instruction. This can often be done effectively through the construction and administration of school-wide or system-wide examinations. Such a procedure will help to indicate the effectiveness of both content and methods of instruction. It will also provide some indication of the extent to which individual needs are being met, and should help to indicate specific teaching needs for the immediate future. [15, 33.]

- *Curriculum evaluation studies should be made at specific times.* While the continuous evaluation by classroom teachers may accurately gauge how well the teachers' immediate objectives are being met, it is imperative to study the system-wide program periodically to evaluate its total effectiveness. [15.]

- *Curriculum evaluation should involve a variety of people who assume different responsibilities.* While classroom teachers assume the most important role in evaluation, other individuals should have definite responsibilities in evaluating the total program. The supervisor, the department head, and ultimately the administrator are responsible for evaluating the total mathematics curriculum. [18.]

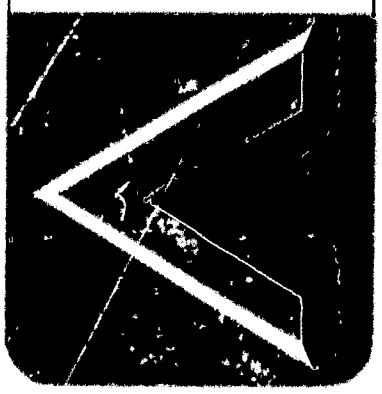
- *Any curriculum evaluation should involve a variety of instruments.* Formal means, such as standardized tests, as well as informal means, such as teacher-devised instruments and trained observation, should

be used to evaluate the mathematics program. Standardized tests to measure achievement in improved programs are scarce; but at least one company, Educational Testing Service, now offers evaluative instruments for modern school mathematics. [15.]

Administrators hold the keys to the continuing improvement of mathematics programs. Superintendents and principals influence the purpose for which school moneys are spent. Ways must be found to obtain support for adequate staff training if children are to be provided with maximum learning opportunities. Vision, influence, and guidance are needed. Without them, needed improvements will not take place. [10, 26.]

Professional organizations of mathematics teachers are not urging an emphasis on mathematics which is out of proportion with respect to other curricular needs. They claim only that the use of the improved materials of instruction now available can make mathematics one of the most challenging, exciting, and important areas of the curriculum. Mediocrity cannot be allowed in this vital area. Administrators can influence, guide, and assure the continued strengthening of the curriculum and students' understanding of mathematics.

Keys to Continuing Improvement



The mathematics curriculum for grades K-12 will continue to undergo substantial change. This is indicated in a report of the long-range goals of school mathematics prepared by a group of recognized mathematicians and mathematics educators [7]. Of significance here is a description of the plans for achieving these goals given by Marshall H. Stone, professor of mathematics at the University of Chicago, in his review of the recommendations of a major conference report:

> The grand goal proposed is to compress the mathematical program so that what is now taught over twelve years of school plus three of college can be completed by the end of high school; that is, in twelve years. How do the authors plan to achieve this goal? The means proposed are essentially those which have been put forward by everyone else who has seen the need for this kind of compression: the introduction of a great deal more mathematics into the elementary school program; better use of the op-

portunities for moving ahead in Grades 7 and 8; a more or less drastic re-evaluation of topics to be included in the curriculum; a more tightly and skillfully organized presentation of the essential elements of school mathematics; and, finally, more stimulating and efficacious pedagogical methods aimed at developing important insights into the structure of mathematics as well as basic manipulative skills.†

Thus the mathematics revolution, which has already influenced the practices of schools, the training of teachers, and the mathematics education of children, has just begun.

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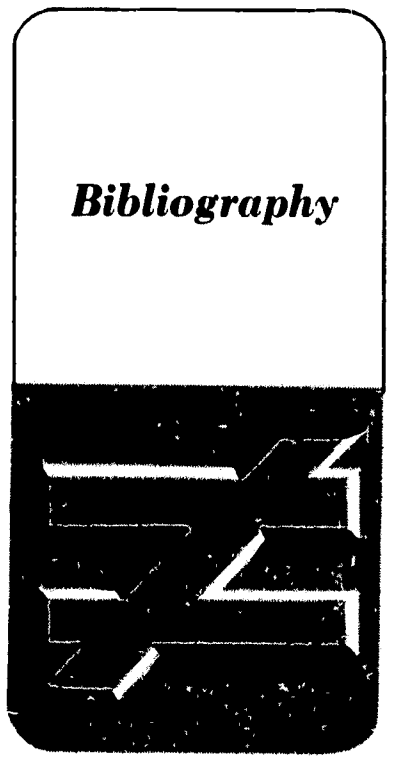
† "Reviews and Evaluations." *The Mathematics Teacher* 58: 354; April 1965.



BOOKS AND PAMPHLETS

1. **Association for Supervision and Curriculum Development,** Commission on Current Curriculum Developments. *New Curriculum Developments.* Washington, D.C.: the Association, 1965. pp. 46-56.

   Characteristics of new programs and a brief description of material available to teachers of mathematics.

2. **Bartnick, Lawrence P.** *Designing the Mathematics Classroom.* Washington, D.C.: National Council of Teachers of Mathematics, 1957. 44 pp.

   Discusses facilities, equipment, supplies, enrichment materials. Gives supply sources, typical prices, and numerous floor plans.

3. **Berger, Emil J., and Johnson, Donovan A.** *A Guide to the Use and Procurement of Teaching Aids for Mathematics.* Washington, D.C.: National Council of Teachers of Mathematics, 1959. 41 pp.

4. **Brown, Kenneth E., and Snader, Daniel W.** *Inservice Education of High School Mathematics Teachers.* U.S. Department of Health, Education, and Welfare, Office of Education. Washington, D.C.: Government Printing Office, 1961. 109 pp.

   The formal papers and a summary of work session deliberations and panel discussions presented at a conference sponsored by the U.S. Office of Education at Washington, D.C., March 17-19, 1960.

5. **Council of Chief State School Officers and National Science Foundation.** *Purchase Guide for Programs in Science and Mathematics.* Boston: Ginn and Co., 1965. 466 pp.

6. **Deans, Edwina.** *Elementary School Mathematics: New Directions.* U.S. Department of Health, Education, and Welfare, Office of Education. Washington, D.C.: Government Printing Office, 1963. 116 pp.

   Discusses current changes and reasons for such changes in elementary school mathematics programs. Selected experimental projects are discussed in detail.

7. **Educational Services Incorporated.** *Goals for School Mathematics: The Report of the Cambridge Conference on School Mathematics.* New York: Houghton Mifflin Co., 1963. ix + 102 pp.

A tentative view of the shape and content for a precollege mathematics curriculum that might be brought into being within the next few decades.

8. GLENNON, VINCENT J. *What Does Research Say About Arithmetic?* Revised edition. Washington, D.C.: Association for Supervision and Curriculum Development, 1962. 32 pp.

9. MATHEMATICAL ASSOCIATION OF AMERICA, Committee on the Undergraduate Program in Mathematics. *Recommendations for the Training of Teachers of Mathematics: A Summary.* Buffalo, N.Y.: the Association, 1961. 15 pp.

10. MILES, MATTHEW B., editor. *Innovation in Education.* New York: Bureau of Publications, Teachers College, Columbia University, 1964. 689 pp.

    See especially page 329, chapter 14, "School Superintendents and the Adoption of Modern Math: A Social Structure Profile."

11. NATIONAL COUNCIL OF TEACHERS OF MATHEMATICS, Committee on Criteria for the Analysis of Instructional Materials. *Aids for Evaluators of Mathematics Textbooks.* Washington, D.C.: the Council, 1965.

    Reprint of an article which originally appeared in the May 1965 issues of *The Mathematics Teacher* and *The Arithmetic Teacher.*

12. NATIONAL COUNCIL OF TEACHERS OF MATHEMATICS. *An Analysis of New Mathematics Programs.* Washington, D.C.: the Council, 1963. 72 pp.

    Designed to assist teachers and administrators. Eight programs are analyzed for content and method.

13. NATIONAL COUNCIL OF TEACHERS OF MATHEMATICS. *Enrichment Mathematics for the Grades.* Twenty-Seventh Yearbook. Washington, D.C.: the Council, 1963. 378 pp.

    Material beyond the usual curriculum, suited for classroom or independent study. Extensive bibliographies.

14. NATIONAL COUNCIL OF TEACHERS OF MATHEMATICS. *Enrichment Mathematics for High School.* Twenty-Eighth Yearbook. Washington, D.C.: the Council, 1963. 398 pp.

    Extends and deepens the knowledge of talented students in the high school and beyond. Extensive bibliographies.

15. NATIONAL COUNCIL OF TEACHERS OF MATHEMATICS. *Evaluation in Mathematics.* Twenty-Sixth Yearbook. Washington, D.C.: the Council, 1961. 216 pp.

Applies basic principles of measurement to the evaluation of achievement in mathematics. Developed around three main themes: general theory, practical techniques, and application to classroom problems.

16. NATIONAL COUNCIL OF TEACHERS OF MATHEMATICS. *The Growth of Mathematical Ideas, Grades K-12.* Twenty-Fourth Yearbook. Washington, D.C.: the Council, 1959. 507 pp.

Traces development of important mathematical concepts from an elementary level through to an advanced level.

17. NATIONAL COUNCIL OF TEACHERS OF MATHEMATICS. *The Revolution in School Mathematics.* Washington, D.C.: the Council, 1961. 90 pp.

Background, nature, and implementation of new programs in secondary mathematics.

18. NATIONAL COUNCIL OF TEACHERS OF MATHEMATICS, Secondary School Curriculum Committee. *The Supervisor of Mathematics: His Role in the Improvement of Mathematics Instruction.* Washington, D.C.: the Council, 1959. 10 pp.

Points out the opportunities and responsibilities of the mathematics supervisor.

19. NATIONAL COUNCIL OF TEACHERS OF MATHEMATICS. *Topics in Mathematics for Elementary School Teachers.* Twenty-Ninth Yearbook. Washington, D.C.: the Council, 1964. 384 pp.

A series of topics presenting key principles for an understanding of sets, the whole numbers, numeration systems for the whole numbers, algorithms for operations with whole numbers, numbers and their factors, the rational numbers, numeration systems for the rational numbers, and number sentences.

20. NATIONAL EDUCATION ASSOCIATION. *The New Mathematics.* Washington, D.C.: the Association, 1964. 10 pp.

A leaflet answering many of the questions about the current trends which are frequently asked by parents, teachers, and administrators.

21. PHILLIPS, HARRY L., and KLUTTZ, MARGUERITE. *Modern Mathematics and Your Child.* U.S. Department of Health, Education, and Welfare, Office of Education. Washington, D.C.: Government Printing Office, 1963. 28 pp.

A guide for parents who have children enrolled in one of the new mathematics programs for the first time.

22. SCHOOL MATHEMATICS STUDY GROUP. *A Very Short Course in Mathematics for Parents.* Pasadena, California: A. C. Vroman, Inc., 367 South Pasadena Ave., 1963. 68 pp.

23. SCHULT, VERYL, and ABELL, THEODORE L. *Inservice Mathematics Education: Promising Practices for Elementary and Secondary School Teachers.* U.S. Department of Health, Education, and Welfare, Office of Education. Washington, D.C.: Government Printing Office, 1964. 129 pp.

Report of a conference held under the joint auspices of the U.S. Office of Education and the National Council of Teachers of Mathematics, Washington, D.C., March 7-8, 1963.

24. SPITZER, HERBERT F. *What Research Says About Teaching Arithmetic.* Washington, D.C.: National Education Association, 1962. 32 pp.

25. WELMERS, EVERETT T. "Arithmetic in Today's Culture." *Instruction in Arithmetic.* Twenty-Fifth Yearbook. Washington, D.C.: National Council of Teachers of Mathematics, 1960.

PERIODICALS

26. ASSOCIATION FOR SUPERVISION AND CURRICULUM DEVELOPMENT. "Mathematics in the School." *Educational Leadership* 19: 353-89; March 1962.

Entire issue devoted to mathematics in the school K-12. Of particular interest may be articles by Beberman, Mayor, Glennon, Rosenbloom, and Rucker.

27. INBODY, DONALD. "Helping Parents Understand New Mathematics Programs." *The Arithmetic Teacher* 11: 530-37; December 1964.

Answers to typical questions asked by the parents of children in elementary schools.

28. KAY, RICHARD, and WOODBY, LAUREN G. "Project Idaho." *The Mathematics Teacher* 58: 241-43; March 1965.

An ongoing pilot project which, in its first year alone (1963-64), enabled 651 elementary school teachers in Idaho to receive in-service education in mathematics from a group of specially trained secondary school teachers.

29. NATIONAL ASSOCIATION OF SECONDARY-SCHOOL PRINCIPALS. "New Developments in Secondary School Mathematics."

Bulletin of the National Association of Secondary-School Principals 43: 3-189; May 1959.

Entire issue devoted to secondary mathematics. Of particular interest may be articles by Beckman, Begle, Gallant, Mayor, McCoy, and Meader.

30. NATIONAL COUNCIL OF TEACHERS OF MATHEMATICS. *The Arithmetic Teacher.* Published monthly October through May. Washington, D.C.: the Council.

Concerned with the teaching of mathematics in kindergarten and in all the grades of the elementary school.

31. NATIONAL COUNCIL OF TEACHERS OF MATHEMATICS. *The Mathematics Teacher.* Published monthly October through May. Washington, D.C.: the Council.

Concerned with the secondary level. Contains articles on mathematics and the teaching of mathematics.

32. NATIONAL EDUCATION ASSOCIATION, DEPARTMENT OF AUDIOVISUAL INSTRUCTION. "The New Mathematics." *Audiovisual Instruction* 7: 136-86; March 1962.

Issue devoted to the "new mathematics" includes articles on programmed courses and the use of audiovisual materials.

FILMS AND FILMSTRIPS

33. DECIDING WHAT TO TEACH. 107 frames, color.
PLANNING AND ORGANIZING FOR TEACHING. 110 frames, color.

National Education Association, Center for the Study of Instruction, 1965. Order from National Education Association, Division of Publications, 1201 16th St., N.W., Washington, D.C.

Each of these filmstrips is accompanied by an 18-min. record; a printed text; and a copy of the study guide, *From Bookshelves to Action.*

34. FILMS IN MATHEMATICS FOR ELEMENTARY SCHOOL TEACHERS. 11 films. 30 min., 16mm, sound, color. National Council of Teachers of Mathematics, 1201 16th St., N.W., Washington, D.C., 1965.

Associated text materials for each film and a teachers' manual for the entire series are available.

35. MATHEMATICS FOR TOMORROW. 29 min., 16mm, sound, color. National Council of Teachers of Mathematics and Mathemati-

cal Association of America, 1965. Order from Audiovisual Sound Studio, 1201 16th St., N.W., Washington, D.C.

36. SMSG Teacher Training Films. 30 films. 30 min., 16mm, sound, color. School Mathematics Study Group, 1965. Order from Modern Learning Aids, 3 East 54th Street, New York 22, N.Y.

Supplementary text provides further reading, problems, and exercises.

Design: William J. Kircher and Associates. Cover: The background design, here reduced one half in size, reproduces a page from a handwritten arithmetic of Colonial days. The original book is a quarto of one hundred pages with a cardboard cover.